11 February 1964

MEMORANDUM FOR: Chairman, Technical Development Committee

THROUGH : Executive Secretary, TDC

SUBJECT : Staff Study - [redacted] Proposal to Study the Feasibility of a Continuous Open-Gate Contact Printer 25X1A

REFERENCE : [redacted] Proposal of 16 January 1964

1. PROBLEM:

To establish the feasibility of achieving and maintaining near absolute contact between negatives and print materials on a flat plane, in an "open-gate" photographic contact printer, for the purpose of eliminating the image degrading effects of curved formats, imperfect contact between films and refractive surfaces in the light path.

2. FACTS:

a. Aerial photographic acquisition equipment, techniques and materials will soon be capable of producing original negatives containing intelligence information at spatial frequencies up to 200 cys/mm. Due to physical image attenuation introduced by the atmosphere, vibration and other elements of the 25X1A photographic system, such high resolution imagery is invariably of low amplitude modulation.

b. Such frequencies at low amplitude modulation demand the highest feasible modulation transfer function to achieve duplicate reproductions with minimum loss of information. To the present, virtually all contact prints are being produced by means of a continuous strip printing technique in which the original and duplicate material are brought into contact under tension over a revolving drum and exposed from a light source directed towards the drum outer surface through a slit aperture. Most other printing methods make use of flat glass platens on which the original and print film are brought into contact by pressure. The drum system introduces image distortion and transfer response losses because of the difference in circumference of the respective negative and duplicate film strands around the printing drum. Further, total intimacy of contact between the two films is not achieved by this system because of unsmooth surfaces inherent in silver halide emulsions. Glass platen systems offer several advantages of operational flexibility over revolving drum printers but introduce other disadvantages, including light scattering effects of glass surfaces in the light path. It also introduces additional surfaces succeptible to scratches and accumulation of dust particles, as well as increased likelihood of newton rings that seriously degrade image quality.

c. Other undesirable characteristics of the drum type printer are that the system does not lend itself to selective printing of single frames or multiple printing of selected frames. Further, and more important, it would be difficult to incorporate automatic exposure control. Inclusion of automatic dodging in the system would be even more difficult.

3. DISCUSSION:

a. In years past, the fidelity of image transfer by contact printing has rarely been questioned because almost any method satisfied the relatively low resolution demands and no precise methods of image evaluation had been devised. As a result, little effort was expended on new and improved concepts. However, the advent of ultra small scale photography of very low contrast, critical measurement techniques and improved materials have contributed to an awareness of various shortcomings in the most commonly used printing equipment and techniques.

b. An analysis of fidelity transfer requirements and the shortcomings of present printing equipment has motivated investigation of other contact printing concepts that may eliminate known deficiencies and achieve the maximum modulation transfer function. One of the principle concepts considered is an open-gate method by which the original negative and print material are held flat, in near absolute contact, by some mutual attraction such as electrostatics, vacuum, adhesive fluids or by some combination of methods that obviate the need for hard support in the image format area.

c. The drum type printer previously mentioned carries the original negative and print material over a curved surface in sandwich form to achieve film contact without glass surfaces in the light path. In doing so, however, it introduces known image distortions that can only be eliminated by holding the two films flat in the exposure area. Furthermore, the drum printer is designed to achieve only nominal contact between the two films, without regard for inherent irregularities in emulsion surfaces. This is necessary by that concept to avoid newton rings and excessive tension on the respective film webs. It, therefore, becomes obvious that to achieve significant advances in the state-of-the-art requires investigation and development of new concepts.

d. Advantages to be gained by an open-gate aperture are not limited to contact printing. Even greater advantages may accrue from uses in photographic enlargers and viewing equipment.

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e. Another area of investigation not specifically included in [redacted] proposal, but intimately related to the effort, is that of electrostatic exclusion or removal of dust from the printing aperture. It has long been known that dust is attracted to film surfaces by electrostatic attraction. It is considered that electrostatic principles may be advantageously utilized to trap or repel dust at the film surface by electrostatic techniques. Because of its close relationship to the problem at hand, this should be included as a part of the total study effort.

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f. [redacted] has proposed to conduct a limited Phase A study program at a fixed price of [redacted] to analyze the limitations of current printing technology and to establish the feasibility of new open-gate printing concepts. The study of new technology will include electrostatics, vacuum and

high pressure air techniques, as well as "liquid gate" technology including materials with adhesive characteristics. Based on results of these studies, a test plan will be developed to evaluate the most promising technology for achieving desired results. Within 30 days after completion of the Phase A
25X1A study, [redacted] proposes to submit the test plan and a proposal for a Phase B extension to implement the test plan.

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g. In next to the last paragraph of the [redacted] proposal, they claim commercial rights to all technology, know-how and inventions emanating from this contract. The writer takes exception to this clause as written for the reasons stated below.

(1) All concepts expressed in their proposal, with exception of "adhesives" were suggested by the writer.

(2) The concept of dust removal by electrostatics, even though not included in their proposal, was also that of the writer.

(3) Several of the benefits that may accrue from this effort will most likely be applicable to many items of present and future equipment employed by the exploitation community. Under the circumstances, it would appear quite unfair to allow one company to retain such monopolistic rights to knowledge gained from Government employees during preliminary technical negotiations and later at Government expense.

4. CONCLUSIONS:

a. Contact printing equipment and techniques have failed to keep pace with state-of-the-art requirements from viewpoints of maximal modulation transfer and operational characteristics.

b. The operational and modulation transfer deficiencies of existing contact printing equipment and procedures demand investigation and development of new printing concepts.

c. Investigation of the proposed open-gate contact printing concepts appear sound and should be pursued.

d. The feasibility of employing electrostatics to exclude or repel dust particles from film surfaces should be included as a part of the proposed study program.

e. Additional benefits may accrue from this investigation that will be of use in photographic enlargers and film viewers.

5. RECOMMENDATIONS:

25X1A a. The study as proposed [redacted] be extended in scope to include the feasibility of employing electrostatics to exclude or repel dust particles from film surfaces.

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b. That the [redacted] proposal be accepted with the provision that the last sentence of next to the last paragraph be stricken and that a contract be negotiated on a CPFF basis, in lieu of fixed price, appropriately adjusted to include the added study requirement recommended above. The total Phase A program is estimated to cost approximately [redacted] 25X1A 25X1A

[redacted]

Development Branch, P&DS